
NEW SPECIES OF LAURACEAE *Henk van der Werff*² FROM ECUADOR AND PERU¹

ABSTRACT

Seven species of Lauraceae from Ecuador and Peru are described and their affinities are discussed. The new species belong to the genera *Caryodaphnopsis* (*C. tomentosa*), *Cinnamomum* (*C. napoense* and *C. palaciosii*), *Endlicheria* (*E. citriodora*), *Ocotea* (*O. alata*, *O. infrafoveolata*, and *O. rotundata*), and *Rhodostemonodaphne* (*R. synandra*).

Intensive fieldwork during the past few years in Peru (by A. Gentry, R. Vásquez, and N. Jaramillo) and Ecuador (mostly by D. Neill, C. Cerón, and W. Palacios) has resulted in a large number of excellent collections of Lauraceae. Several of these represent undescribed species and seven of the most striking ones are described in this contribution. I expect that as long as these collecting efforts continue, more undescribed species will become known and articles such as this one, describing these novelties, will appear with some regularity.

Caryodaphnopsis tomentosa van der Werff, sp. nov. TYPE: Ecuador. Napo, Estación Biológica Jatun Sacha, tree, 25 m tall, flowers green, 7 Aug. 1989, *Palacios 4337* (holotype, MO; isotypes, AAU, BOG, CR, F, GH, HBG, K, KUN, L, LE, QAME, QCE, QRS, NY, P, S, US). Figure 1.

Ab speciebus ceteris *Caryodaphnopsis* ramulis et foliis subtus tomentosus, staminibus fertilibus 6, bilocellatis, recedit.

Tree, 25 m tall, the trunk with buttresses 1 m high. Twigs terete or slightly quadrangular, brown-tomentose when young, becoming glabrous. Terminal bud brown-tomentose. Leaves opposite, coriaceous, 8–18 × 3–7 cm, elliptic, the base obtuse or acute, the tip acute, triveined, the 2 lateral veins beginning at the very leaf base and ending in the apex, impressed on the upper surface and prominently raised on the lower surface, the perpendicular tertiary veins raised on the lower surface, the lateral veins with up to 10 branchlets toward the margin, these strongly arching upward and loop-

connected; lamina glabrous above or with traces of pubescence at the bases of the major veins, brown-tomentose on lower surface. Petioles to 1 cm long, tomentose. Inflorescences clustered in the axils of leaves, paniculate, with opposite or alternate branching, to 7 cm long, whitish tomentellous in sicco, flowers grouped in cymes. Bracts of inflorescences persistent, linear, the larger ones ca. 2 mm long, bracts subtending flowers only half as long. Pedicels 2–3 mm long. Flowers green, without odor (fide collector). Tepals 6, strongly unequal, the outer three broadly ovate to roundfish, ca. 1 mm long, pubescent outside, glabrous inside, spreading; inner tepals erect, ca. 3 mm long, elliptic, pubescent outside, inside with some scattered hairs mostly near the margin. Stamens of whorls I and II fertile, 2-celled, 1.5 mm long, the filament 1 mm long, dorsally pubescent, otherwise glabrous; stamens of whorl III 0.7 mm long, sterile or with 2 minute, vestigial locelli, the filament with two basal glands, the anther well developed and clearly differentiated from the filament; staminodia (whorl IV) ca. 0.7 mm long, with a pubescent filament and glabrous, cordate tip. Ovary glabrous, ellipsoid, gradually narrowed into the slender style. Receptacle shallow, pubescent inside.

Caryodaphnopsis tomentosa is a very distinctive species by virtue of its tomentose pubescence on twigs and leaves, its pubescent inflorescences and flowers, the presence of only six fertile two-celled stamens, and its coriaceous leaves with strongly raised venation. Although its androecium is unique in *Caryodaphnopsis*, it possesses all other characters of the genus, such as opposite leaves, strongly unequal tepals, and a long, slender style.

¹ Luther Raechal kindly photographed the type specimens. Drawings were made by John Myers. I thank the National Geographic Society for financial support of fieldwork in Peru and Ecuador (grant numbers 3480-86 and 3821-88).

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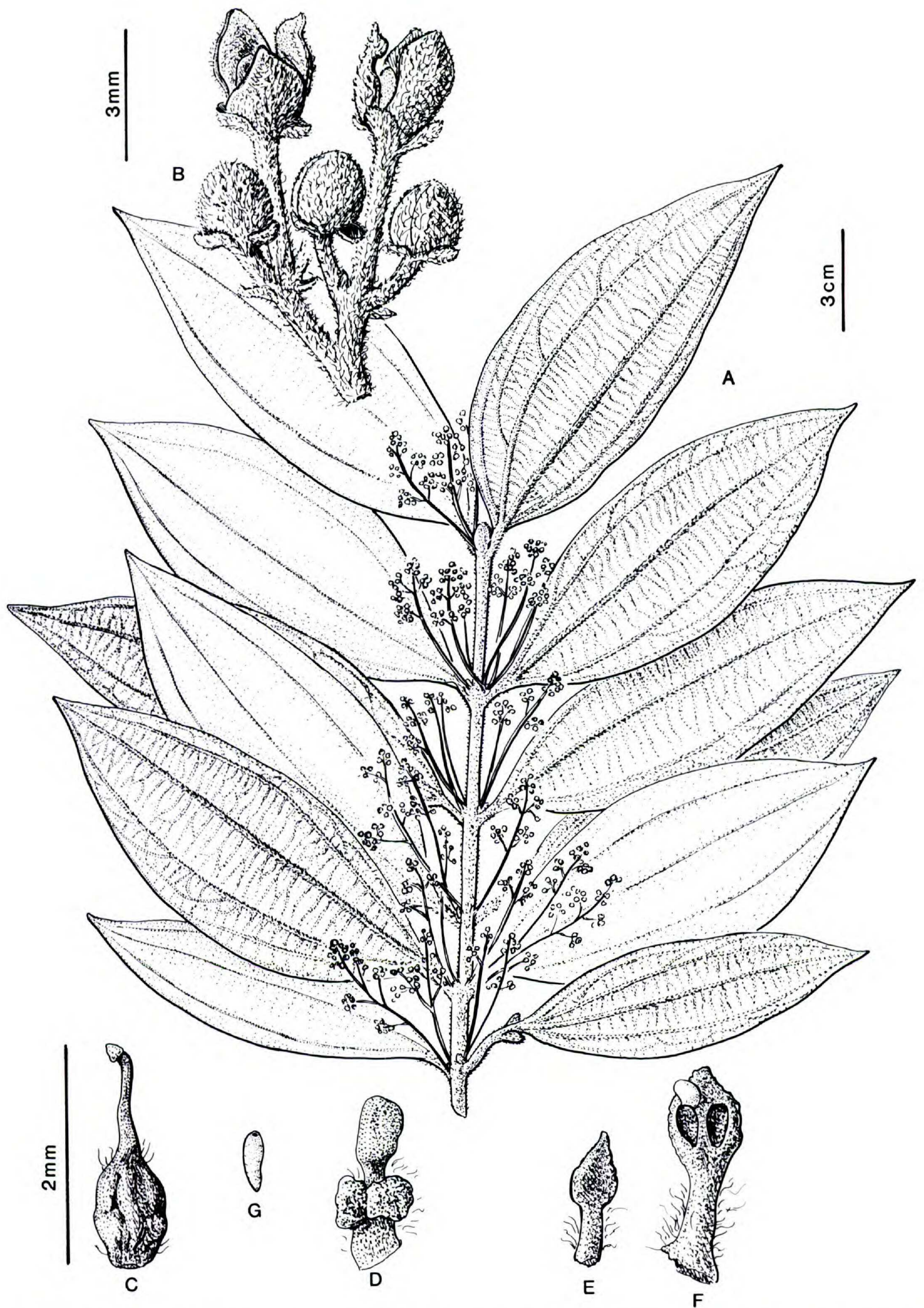


FIGURE 1. *Caryodaphnopsis tomentosa*.—A. Habit.—B. Detail of inflorescence.—C. Pistil.—D. Stamen of whorl III (sterile).—E. Staminode of whorl IV.—F. Stamen of whorl I/II ventral view.—G. Larva inside flower.

Although *Caryodaphnopsis tomentosa* is only known with certainty from the type collection, three sterile collections from Peru probably represent the same species. These are: *Gentry et al.* 42762 (MO) and *Vásquez & Jaramillo* 6387 (MO), both from Yanamono, Explorama Tourist Camp, Maynas, Loreto, and *Gentry et al.* 55831 (MO), from the Explorama Inn, Maynas, Loreto. In venation and indument these collections are a good match for the type collection.

Although fruits have not yet been collected, they were described by the collector as small and round, a fruit type which is to be expected in this group of *Caryodaphnopsis* species with strongly tri-veined leaves (van der Werff, 1988). The collector noted that small white larvae were frequently present in the flowers and, indeed, larvae were found in most dissected flowers.

Cinnamomum Schaeffer

The group of species to which *Cinnamomum napoense* and *C. palaciosii* belong has been included in *Phoebe* by earlier authors (Mez, 1889, for instance). Because Mez was the last person to survey all neotropical Lauraceae, his concepts of species and genera have long remained unchallenged. Until now I have, with some hesitation, accepted Mez's concept (van der Werff, 1987, 1988). Kostermans (1961) argued for the transfer of neotropical *Phoebe* species to *Cinnamomum* and made the necessary new combinations. Because various neotropical species of other genera have been erroneously described in *Phoebe*, I felt that these problems needed to be sorted out before accepting the remaining species in *Cinnamomum*. I have now changed my mind on this; it makes no sense to describe new species in a genus to which they do not belong. Although the problems with the delimitation of *Cinnamomum* are not solved and generic concepts may change again in the future, I think the neotropical species formerly treated in *Phoebe* are, with some exceptions, more closely related to *Cinnamomum* than to any other genus, and I accept *Cinnamomum* as their generic name. Wood anatomical characters also support the transfer of neotropical *Phoebe* species to *Cinnamomum* (Richter, 1981).

The neotropical *Cinnamomum* species have two areas of species richness: northern Central America and southern Brazil. The genus is poorly represented in other neotropical areas. Most collections from northern South America belong to the *C. cinnamomifolia* complex, which usually occurs in montane habitats (mostly 1,200–2,000 m). Although Mez (1889) reported the genus from Co-

lombia and Peru, it has apparently not been recorded from Ecuador. Recent fieldwork has shown that it is represented by at least three, and probably more species in Ecuador. Further collecting may demonstrate that the paucity of known *Cinnamomum* species in northern South America reflects incomplete collecting and that the genus is represented by more species than previously thought.

A possibly useful character in the identification of *Cinnamomum* is the odor of the flowers. The species of *Cinnamomum* I have collected (*C. costaricanum* (Mez & Pitt.) Kostermans, *C. cinnamomifolium* (HBK) Kostermans s.l. in Venezuela and Ecuador, and *C. palaciosii* van der Werff) all had flowers with a similar odor of urine. As a rule, Lauraceae have pleasantly fragrant flowers, and therefore I think this peculiar odor is indicative for the neotropical *Cinnamomum* species.

Cinnamomum napoense van der Werff, sp. nov. TYPE: Ecuador. Napo, Estación Biológica Jatun Sacha, tree, 7 m, 2–5 Sep. 1988 (fl), *Palacios* 2886 (holotype, MO; isotypes, QCE, QAME, AAU, HBG, NY, US). Figures 2B, 3A–F.

Ab ceteris speciebus subgeneris *Heterantherae* Mez foliis majoribus, petiolis longioribus et costarum axillis subtus non-barbellatis differt.

Trees, to 15 m tall. Twigs terete, glabrous or minutely puberulous when young, with a soft pith and sometimes fistulose. Terminal bud densely puberulous. Leaves alternate, somewhat clustered near the tips of branches, chartaceous, 18–30 × 6–12 cm, elliptic, the base acute or rarely obtuse, the tip acute, upper surface glabrous, lower surface glabrous and densely gland-dotted, sometimes with minute, appressed hairs along the major veins, lateral veins 5–8 on each side, arching upward near the margin and somewhat loop-connected in the upper ¼ of the leaf, midrib and lateral veins impressed on upper surface and prominently raised on lower surface, the tertiary venation less raised and drying lighter than the lamina. Basal lateral veins stronger developed than the upper ones. Tufts of hair absent from the axils of the lateral veins. Petioles glabrous, canaliculate, 3–4.5 cm long. Inflorescences clustered on very short, leafless shoots in the axils of normal leaves or along the twigs, minutely puberulous, 5–15 cm long, paniculate, the ultimate division(s) usually cymose, but occasionally racemose. Flowers yellow, pedicels 3–4 mm long. Tepals 6, erect at anthesis, ovate, 1.5–2 mm long, on both surfaces with some appressed hairs, united at the base and falling off together

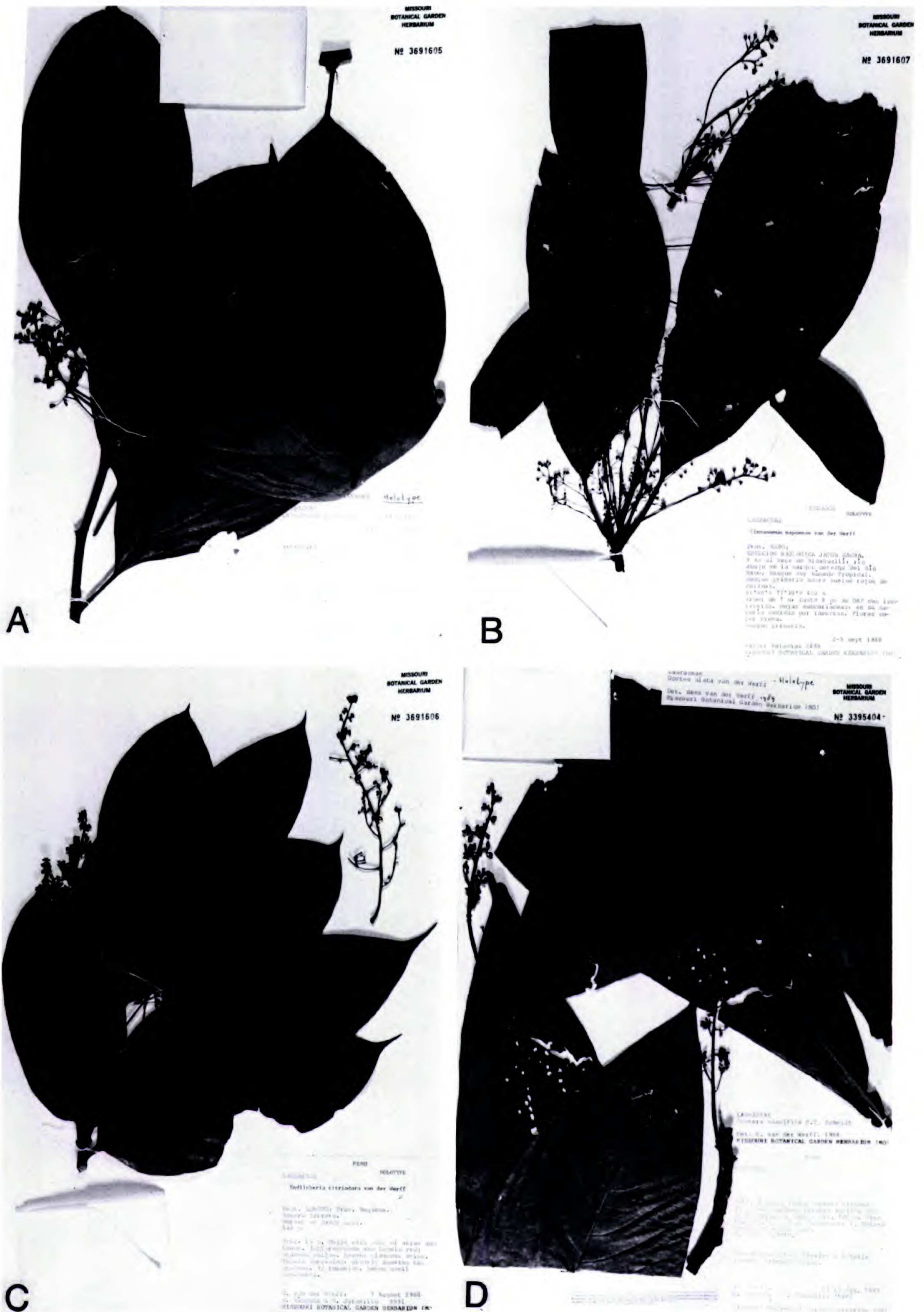


FIGURE 2.—A. *Cinnamomum palaciosii*.—B. *Cinnamomum napoense*.—C. *Endlicheria citriodora*.—D. *Ocotea alata*.

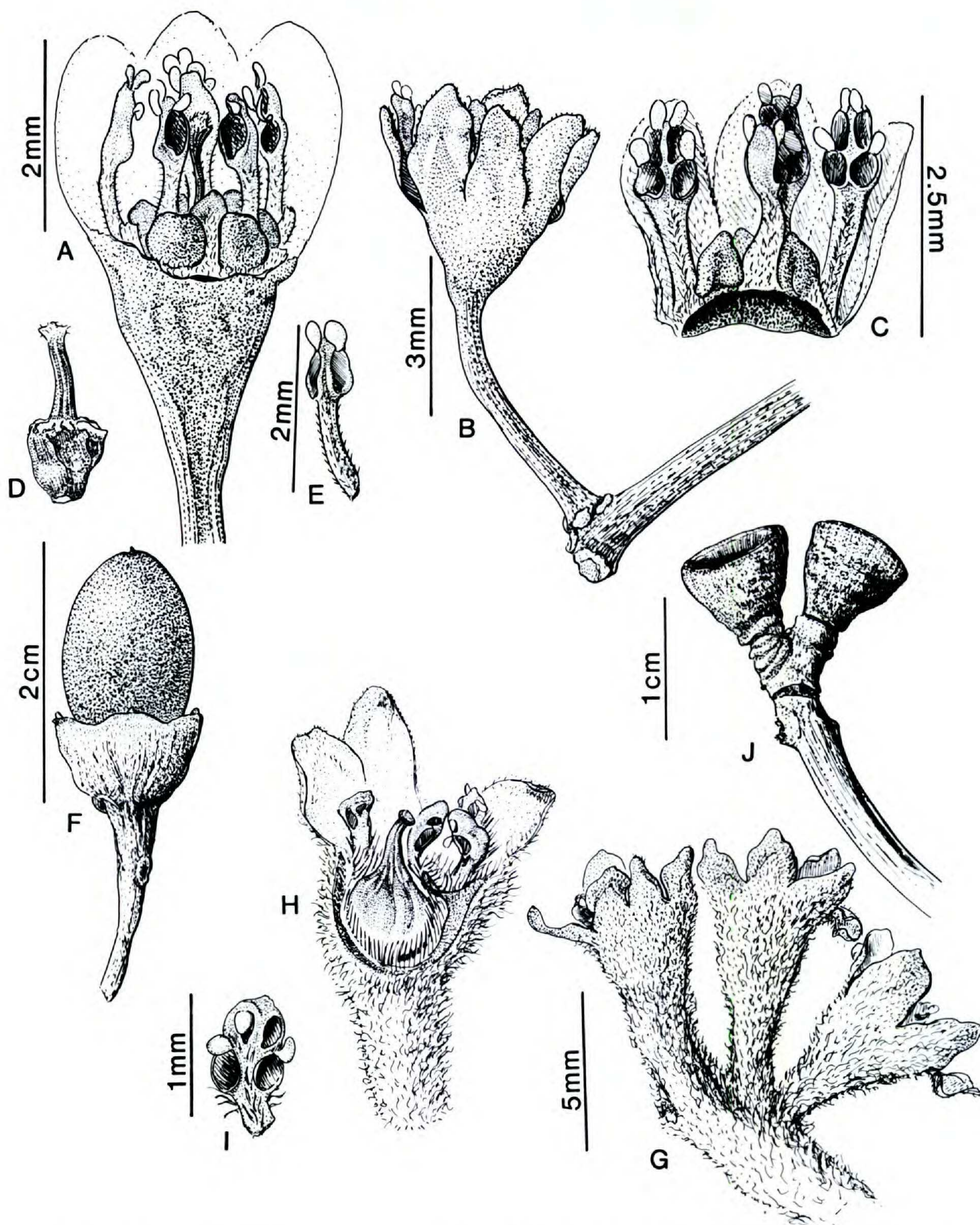


FIGURE 3. A–F. *Cinnamomum napoense*. — A. Floral detail. — B. Flower, outside. — C. Three fallen tepals, with 4-celled stamens of whorl I/II, a 2-celled stamen of whorl III with basal glands and a staminode. — D. Pistil. — E. Stamen of whorl III, the basal glands lacking, dorsal view. — F. Cupule with fruit. G–J. *Ocotea rotundata*. — G. Part of inflorescence. — H. Flower with several tepals removed. — I. Stamen of whorl I/II, ventral view. — J. Cupules.

with the stamens in old flowers. Stamens 9, the outer six 4-celled, attached near the base of the tepals and slightly shorter than them, anthers ca. 0.8 mm long, cells opening introrsely and arranged in 2 horizontal pairs, the filament gradually widened into the anther, with some short hairs, especially dorsally; the inner 3 and staminodia attached on a ridge which is bent inward and largely covers the ovary, inner 3 stamens 2-celled, slightly shorter than the stamens of the outer whorls, the cells

opening extrorsely, the sparsely pubescent filament about as long as the anther; glands small, attached at the base of the stamens of the whorl III; staminodia 3, ca. 0.6 mm long, with a very short, pubescent filament and a large, sagittate tip. Ovary glabrous, ellipsoid, included in the receptacle, style slender, about as long as the ovary, the entire pistil ca. 1.8 mm long; receptacle with scattered hairs inside. Cupule ca. 1 cm tall, the rim slightly lobed, the young fruit included, older fruits greatly exserted,

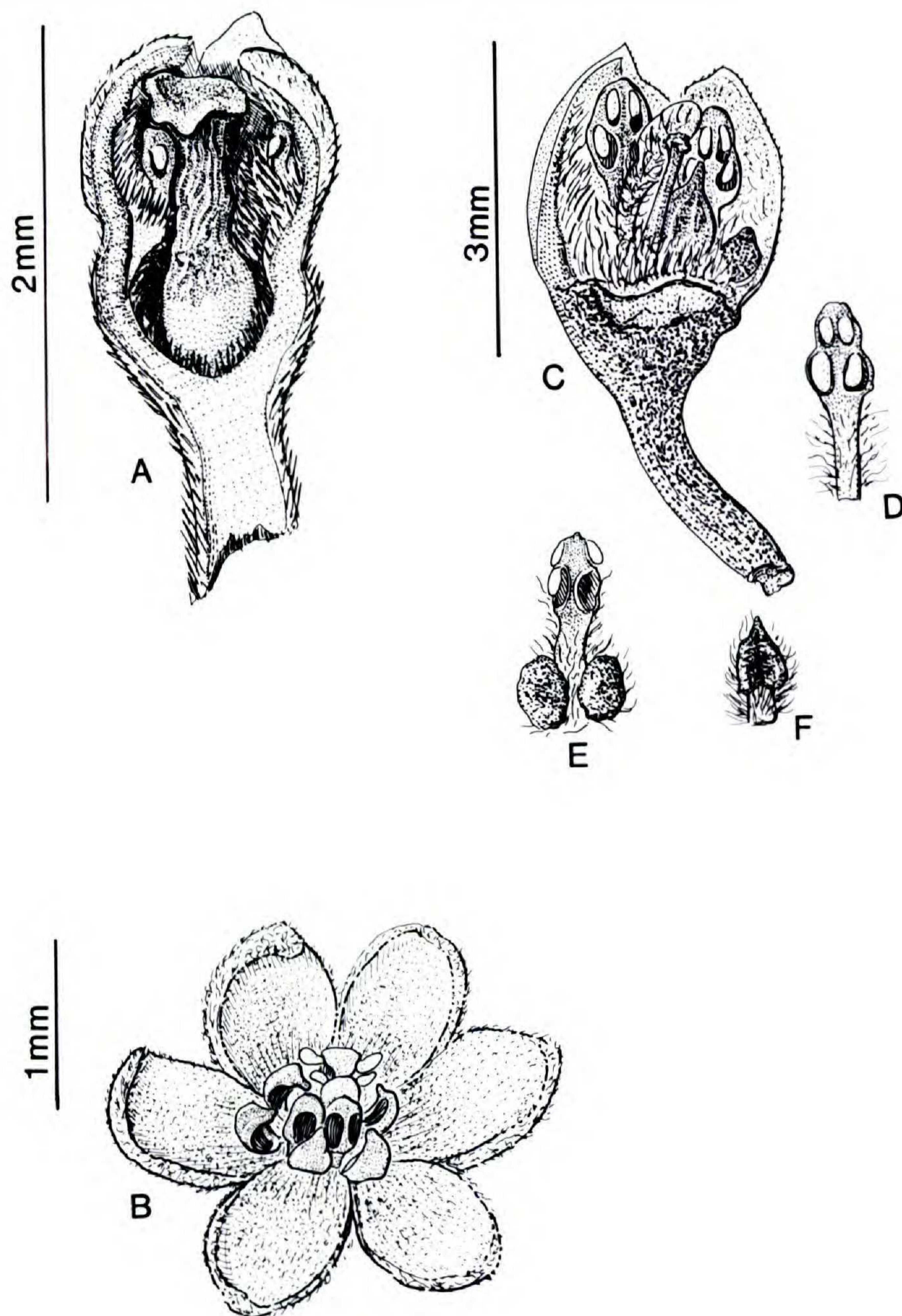


FIGURE 4. A, B. *Endlicheria citriodora*.—A. Cross section through pistillate flower.—B. Staminate flower. C–F. *Cinnamomum palaciosii*.—C. Flower, with some tepals removed.—D. Stamen of whorl I/II, ventral view.—E. Stamen of whorl III, dorsal view.—F. Staminode of whorl IV.

ca. 2 cm long; margin of cupule often with remnants of stamens.

Paratypes. ECUADOR, NAPO: Río Wai si ayá, *Brandbyge et al.* 36207 (fl) (AAU); San Pablo de los Secoyas, *Brandbyge et al.* 36229 (fl) (AAU); km 32 carretera Hollin-Loreto, *Neill et al.* 8605, (fl) (MO, QAME); Reserva Biológica Jatun Sacha, *Palacios* 1316 (fl) (MO, QAME), 4396 (MO, QAME), *Cerón* 5970 (fr) (MO, QAME); Río Napo, 8 km from Pto. Misahualli, *Palacios* 2979 (fl) (MO, QAME); Añangu, *SEF* 8807 (fr) (NY); Reserva Florística El Chuncho, *Zaruma* 611 (MO, QAME).

Flowers: August–September; fruits (mature): January. By virtue of its 2-celled anthers of the whorl III of stamens, *Cinnamomum napoense* belongs to subg. *Heteranthera* Mez. This subgenus consists of two Peruvian and several Brazilian spe-

cies. The Brazilian species differ in their smaller leaves (less than 10 cm long), shorter petioles (less than 15 mm long) and often dense pubescence on the lower side of the leaves. Of the two Peruvian species, *C. subsessile* (Meissner) Kostermans has subsessile leaves with a cordate base and *C. heteranthera* (R. & P.) Kostermans has small (to 9 cm long) leaves with tufts of hair in the axils of the lateral veins. Thus, *C. napoense* differs from the other species of subg. *Heteranthera* by its large leaves, long petioles, and lack of axillary tufts of hair. In older flowers the tepals break off just above their base and the margin of the cupule is slightly undulating due to the presence of the short tepal bases. Often a few stamens also persist on the margin of the cupule.

Cinnamomum palaciosii van der Werff, sp. nov. TYPE: Ecuador. Imbabura: forest remnant along road Apuela-Otovalo near Apuela, elev. 2,000 m, 14 Feb. 1989, *van der Werff & Palacios 10575* (holotype, MO; isotypes, AAU, QAME, QCE, NY, K, US). Figures 2A, 4C–F.

Ab congeneribus foliis magnis, inflorescentiis tomentellis et floribus pedicellisque glabris differt.

Tree, 25 m, with divided buttresses. Twigs angular, solid, when very young yellow-brown tomentellous, the indument becoming gray and sparser on old twigs. Terminal bud densely yellow-brown pubescent. Leaves alternate, chartaceous, 15–25 × 8–15 cm, broadly elliptic or elliptic-oblong, the tip shortly acuminate, the acumen ca. 1 cm long, the base cuneate or narrowly acute, midrib and lateral veins impressed on upper surface, prominently raised on lower surface, the tertiary venation less raised; lateral veins 3–5 on each side, the basal pair much more strongly developed than the upper ones, thus the leaves subtripliveined, the second pair of lateral veins near or above the middle of the lamina; upper surface glabrous with the exception of some pubescence on midrib and basal lateral veins, lower surface sparsely (occasionally densely) appressed pubescent with the hairs not all oriented in the same direction, barbellate in the axils of the lateral veins. Petioles 2–3 cm long, canaliculate, with similar indument as twigs. Inflorescences single or a few together on short, leafless spurs, 4–14 cm long, paniculate, with the ultimate divisions cymose or sometimes appearing racemose through loss of the lateral flowers of a cyme, densely yellow-brown tomentellous, especially along the main axis; bracts frequently present, tomentellous-pilose on outside, glabrous inside, 1–3 mm long, ovate to (very) narrowly ovate; pedicels and flowers glabrous and contrasting markedly with the pubescent inflorescence. Pedicels terete, to 5 mm long, the lateral flowers of a cyme often with shorter pedicels. Flowers green, smelling of urine. Tepals 6, equal, erect at anthesis, ovate, 3–3.5 mm long at anthesis, glabrous outside, the 3 inner ones pubescent inside, especially toward the base. Stamens 9, all 4-celled, the outer 6 with the introrse cells arranged in 2 horizontal rows; the anther ca. 1 mm long, about as long as the pubescent filament; inner 3 stamens with narrow anthers, the cells lateral-extrorse, filaments with 2 large glands near the base and slightly longer than the anthers; staminodia 3, 1.5 mm long, the cordate tip ca. 0.8 mm long, filament pubescent; ovary glabrous, globose,

style slender, ca. 1.5 mm long. Receptacle pubescent inside. Fruit unknown.

Cinnamomum palaciosii, known only from the type collection, belongs to *Phoebe* subg. *Phoebe* sensu Mez. Within this subgenus, it keys to *Cinnamomum salicifolium* (Nees) Kostermans, a poorly known Mexican species with much smaller leaves and smaller flowers. The new species can be readily recognized by its large, tripliveined leaves with an angustate or cuneate base, and the rather large, glabrous flowers contrasting with the tomentellous inflorescence.

It is a pleasure to name this species after Ing. Walter Palacios, who accompanied me on several field trips in Ecuador and who has collected several undescribed species of Lauraceae.

Endlicheria citriodora van der Werff, sp. nov.

TYPE: Peru. Loreto: Maynas, Jenaro Herrera, roadside near the arboretum, 7 Aug. 1988 (fl), *van der Werff, Vásquez & Jaramillo 9991*, ♂ (holotype, MO; isotypes, AMAZ, HBG). Figures 2C, 4A, B.

A congeneribus foliis subtus glaucis, indumento ramulorum brunneo et ramulis citriodoris diversa est.

Dioecious tree, to 25 m tall. Twigs longitudinally ridged, roundish, densely brown-tomentellous with the odor of lemon and anise, the lemon scent dominating. Terminal bud brown-tomentellous. Leaves alternate, firmly chartaceous, 15–30 × 7–14 cm, elliptic, oblong or elliptic-ovate, the base obtuse, tip sharply acute to acuminate, the upper surface glabrous except for the tomentellous midvein, the lower surface glaucous and with varying amounts of small, appressed hairs, these never obscuring the surface; lateral veins 7–10 on each side, arching upward near the margin but not becoming loop-connected, immersed on the upper surface, raised on the lower surface, the midvein prominently raised below, tertiary venation faintly visible on both surfaces. Petioles 2–3.5 cm long, with similar indument as twigs, the adaxial side flat, the abaxial side rounded. Inflorescences reddish, in axils of regular leaves or cataphylls, 10–15 cm long, brown-tomentellous, 2–3 times branched, the ultimate branching cymose; in staminate plants the ultimate cymes usually sessile, the flowers thus in dense groups of 6–7 (rarely 9 or 13) flowers. Pedicels 1.5–2.5 mm long and flowers densely, minutely pubescent, the indument covering the surface entirely. Receptacle deep, ca. 0.7 mm long, slightly constricted near the tip, densely pubescent inside. Tepals 6, equal, spreading at anthesis, the tips bent inward, ca. 0.7 mm long, ovate-elliptic, with some

hairs on the inner surface. Male flowers: tepals reddish and stamens yellow, at anthesis the tepals spreading and the stamens fully exposed. Stamens 9, all 2-celled, the outer 6 ca. 0.5 mm long, almost sessile, the filament narrower than the anther, the cells large, the connective extending beyond the cells, filament with some hairs at the base; inner 3 stamens with extrorse cells, 0.7 mm long, the pubescent filament about as long as and wider than the anther; no glands seen on the filaments. Pistillode threadlike, glabrous, without a stigma, not surpassing the stamens. Female flowers: tepals at anthesis erect, the tips slightly incurved. Stamnodes 0.3–0.5 mm long, the filaments broad, pubescent, anthers 2-celled, the cells opening. Stamnodes surpassed by the style and more or less hidden under the stigma. Pistil 1.2–1.5 mm long, glabrous, ovary about as long and wide as the style, stigma large, peltate. Cupule shallowly cupshaped, red in vivo, smooth, 1.1 × 1.9 cm; in sicco black, this contrasting sharply with the tan-pubescent pedicel. Fruit ellipsoid, ca. 2.5 × 1.5 cm.

Paratypes. PERU. LORETO: Requena, Jenaro Herrera, *A. Castillo 13*, ♂ (fl) (MO), tree 4-478, *A. Castillo 34*, ♂ (fl) (MO), *Vásquez & Jaramillo 9593*, ♂ (fl) (MO, AMAZ); Maynas, Puerto Almendras *van der Werff et al. 9776* (st) (MO, AMAZ); Maynas, Mishana, *Gentry et al. 25983* (st) (MO) *Gentry et al. 39301* (fr) (MO), *van der Werff et al. 10187*, ♀ (fl) (MO, AMAZ); Maynas, Alpuhuayo, field station of IIAP, *van der Werff et al. 10242*, ♂ (fl) (MO, AMAZ).

Flowers: August–September; fruits January. Common names: Limón-moena, Anis moena.

Endlicheria citriodora has been collected in the vicinity of Iquitos and Jenaro Herrera in Amazonian Peru. It is restricted to a forest type locally called “varillal,” a ca. 25–30-m-tall, closed forest on a substrate of predominantly white sand with a small amount of clay. The glaucous lower leaf surface and the lemon scent are very good field characters; the scent is less pronounced in dried material, and specimens preserved in alcohol lose the glaucous cast. The two Castillo collections have retained the striking glaucous lower leaf surfaces.

The deep floral tube, constricted near the apex, resembles the shape of *Aniba* flowers. However, the unisexual flowers, anthers with large locelli and the smooth, fleshy cupule are characteristic of *Endlicheria*. This genus was last revised by Kostermans (1937) and is in need of an updated treatment. The closest relatives of *E. citriodora* are in the group of species with a deep receptacle and spreading tepals (*E. klugii* O. C. Schmidt, *E. browniana* Mez, *E. pyriformis* (Nees) Mez, *E. metallica* Kostermans, among others). The glau-

cous lower leaf surface, the indument of twigs and inflorescence and the lemon odor make identification easy, however.

An unusual character of the staminate inflorescences is the frequent suppression of the peduncles of the ultimate cymes. Thus, the flowers appear in pseudo-umbellate clusters, mostly consisting of six flowers (two cymes along an axis), or seven flowers (a terminal cyme with the two lateral divisions again cymosely branched). Occasionally, when the ultimate part of the main axis also becomes suppressed, the pseudo-umbels may consist of nine (one terminal and two lateral cymes condensed) or 13 (two lateral and a branched terminal cyme) flowers. Frequently, the number of flowers is smaller, because the central flowers of each cyme develop faster than the laterals and fall off before the laterals.

Ocotea alata van der Werff, sp. nov. TYPE: Peru.

Loreto: Maynas, Mishana, Río Nanay halfway between Iquitos and Santa María de Nanay, upland forest on white sand, 12–13 Jan. 1983, ♀ (fl), *Gentry et al. 39447* (holotype, MO). Figure 2D.

Ab *Ocotea glomerata* et *O. magnifica* ramulis alatis et foliis basi rotundatis vel subcordatis recedit.

Dioecious tree to 20 m tall, but mostly less than 10 m. Twigs winged, the wings to 5 mm broad, young twigs densely tomentellous, glabrescent with age. Terminal bud densely tomentellous. Leaves alternate, chartaceous, 35–65 × 10–20 cm, (narrowly) obovate or elliptic, the base abruptly rounded to subcordate, the tip acute to acuminate, the upper surface glabrous, the lower surface with short, erect hairs ca. 0.2 mm long, the pubescence sparser and shorter on old leaves, the surface always visible; venation immersed on upper surface, midvein prominently raised on lower surface, the lateral veins (15–20 on each side) raised and tertiary venation slightly raised; lateral veins arching upward near the margin and becoming weakly loop-connected in the upper half of the lamina. Petioles 1–1.5 cm long, to 6 mm thick, canaliculate, with the same indument as twigs. Inflorescences in axils of leaves or cataphylls, 15–25 cm long, densely tomentellous, the lateral branches once or twice cymosely branched, many-flowered. Flowers sessile or nearly so, white, the tepals erect at anthesis. Tepals 6, equal, 1.5–2.0 mm long, densely appressed pubescent outside, sparsely pubescent inside, broadly ovate-elliptic. Male flowers: stamens 9, all 4-celled, glabrous, the outer 6 with introrse

cells, ca. 1 mm long, the filaments distinct, 0.4 mm long; inner 3 stamens fused, ca. 1 mm long, the cells extrorse; glands small, globose, attached at the base of the inner stamens; pistillode linear, enclosed by the inner stamens, with a small stigma, glabrous, the receptacle pubescent inside. Female flowers: staminodes 9, traces of anther cells visible but locelli not opening, inner 3 staminodes free; stigma platelike, raised above the staminodes, ovary globose, glabrous, enclosed in the glabrous receptacle. Tepals initially persisting in the fruiting stage, but finally deciduous. Immature fruit enclosed in receptacle, mature fruit ovoid, ca. 15 × 9 mm, largely exserted, the cupule deeply cup-shaped.

Distribution: Amazonian Peru, from Jenaro Herrera downstream to the Brazilian border.

Paratypes. PERU. LORETO: Prov. Requena, Jenaro Herrera, *Gentry et al.* 21199, ♂ (fl) (MO); *Spichiger & Encarnación* 1167, tree 6/125, ♂ (fl) (MO); *Vásquez & Jaramillo* 232, ♂ (fl) (MO); *van der Werff et al.* 10089, (st) (MO); collector unknown, tree 6/125, ♂ (fl) (MO); Prov. Loreto, Nauta, *Vásquez & Jaramillo* 5059, ♂ (fl) (MO); *Revilla* 925 (young fr) (MO), 1640, ♂ (fl) (MO); *Rimachi* 3745 (fr) (MO); *Vásquez & Jaramillo* 4483, ♂ (fl) (MO), 8697, (young fr) (MO), 8918, (fr) (MO); Prov. Maynas, border post on Río Javeri, *Gentry & Revilla* 20897 (fr) (MO).

Flowers year round (January, April, June, July, October, November, December); fruits collected in March, July, and November.

Ocotea alata belongs to the *O. guianensis* group of Rohwer (1986) because of its nearly sessile flowers, the fused stamens of whorl III, the persistent tepals of the young fruit, and the cupule shape. Within this group, it is most closely related to *O. glomerata* (Nees) Mez s.l., the only species with erect pubescence on the lower leaf surface. Part of *O. glomerata* s.l. is *O. magnifica* O.C. Schmidt (isotype, NY). This segregate has larger leaves with an inrolled base and a typical indument on the lower leaf surface (a dense, tomentellous pubescence and longer erect hairs), and is only known to me from the type collected at the middle Ucuyali. Two recent collections from the Tingo María area have the pubescence characters of *O. magnifica*, but resemble *O. glomerata* in leaf size and absence of an inrolled base. More collections are needed to determine the status of *O. magnifica*. *Ocotea alata* resembles *O. magnifica* in leaf size, but can be easily recognized by its winged stems and rounded leaf base. In the past, I have identified all cited specimens as *O. magnifica* and duplicates have been distributed under that name. Spichiger et al. (1989) also used the name *O. magnifica* for

specimens from Jenaro Herrera; their illustration does not show the abruptly rounded leaf base, although they correctly describe this character. *Ocotea alata* occurs in varillal (see previous species).

***Ocotea infrafoveolata* van der Werff, sp. nov.**

TYPE: Ecuador. Zamora-Chinchipec: at the pass of the Loja-Zamora road, wet scrub, elev. 2,900 m, 12 Feb. 1985, *Harling & Andersson* 21968 (holotype, GB; isotype, MO). Figure 5.

Arbor parva, ramulis crassis, juvenalibus ferrugineo-tomentosis, vetustioribus glabris; foliis ellipticis, subtus ferrugineo-tomentosis, valde foveolatis; inflorescentiis axillaribus, paniculatis; floribus hermaphroditis, ca. 1 cm diametro; staminibus 9, 4-locellatis; staminodiis nullis, cupula parva.

Shrub or small tree, 6(–10) m tall. Twigs angular, ferruginous tomentose when young, becoming glabrous, often with conspicuous scars of fallen leaves. Leaves alternate, 6–15 × 2.5–6 cm, strongly coriaceous, elliptic to elliptic-oblong, the tip acute, the base gradually narrowed, at the very base revolute and decurrent on the petiole; the upper surface of very young leaves tomentose, this tomentum soon disappearing and the surface shiny and glabrous except for traces of tomentum on the main veins and the margin; lower surface with a dense, ferruginous tomentum, the midvein, secondary and tertiary veins with a lanate ferruginous pubescence, the surface between veins covered with a shorter, lighter-colored tomentose pubescence, or rarely the tomentum absent, both kinds of pubescence thinner and lighter colored with age; lateral veins 10–15 pairs, midvein and lateral veins immersed on upper surfaces, but, together with tertiary venation, prominently raised on the lower surface, which is strongly pitted by the raised reticulation; margin of the leaves revolute, more strongly so toward the base of the leaves. Petioles broad, ca. 5 mm wide, and to 1 cm long, but mostly poorly defined because of the decurrent laminae; pubescence on young petioles a ferruginous tomentum, this wearing off with age. Inflorescences axillary, paniculate, 10–16 cm long, branching in the upper half, the peduncle to 10 cm long; bracts supporting the basal branchlets of large inflorescences occasionally leaflike and persisting; inflorescence ferruginous tomentose near base, becoming ferruginous lanate in the distal part. Flowers hermaphrodite, greenish yellow, sessile or nearly so, subtended by a narrowly ovate, ferruginous tomentose bract, to 5 mm long. Tepals 6, equal, spreading ovate, 4 mm long, 3 mm wide, ferru-

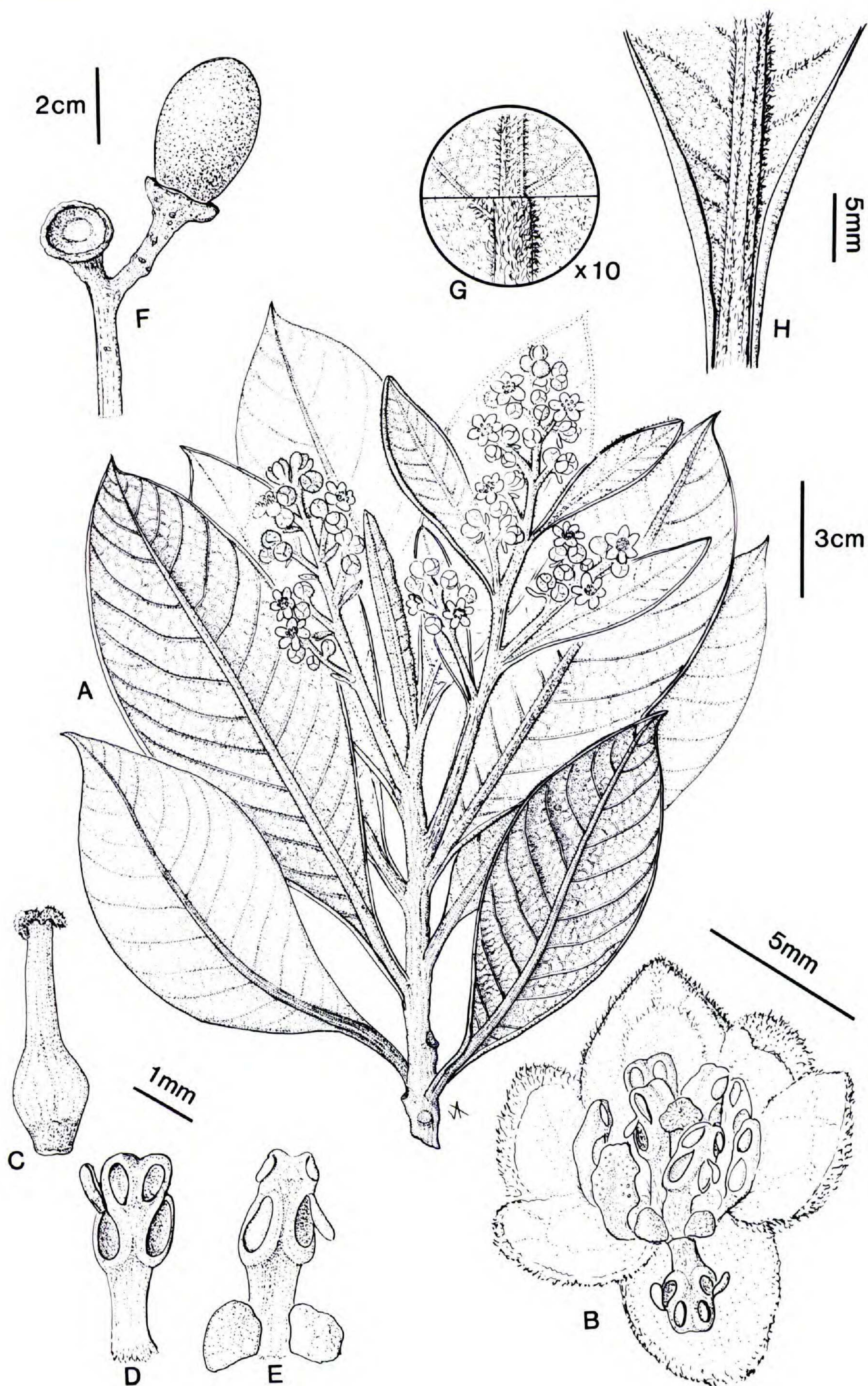


FIGURE 5. *Ocotea infrafoveolata*. — A. Habit. — B. Flower. — C. Pistil. — D. Stamen of whorl I/II, ventral view. — E. Stamen whorl III, dorsal view. — F. Cupule and fruit. — G. Detail of pubescence along midrib on lower leaf surface (lower half) and upper leaf surface (upper half). — H. Leaf base.

ginous tomentose outside, the pubescence more appressed on the inner face of the tepals; fertile stamens 9, all 4-celled, the outer 6 with introrse cells, the filaments glabrous or with few hairs, ca. 0.5 mm wide and 1 mm long, the anthers glabrous, ca. 0.8 mm wide and 1.2 mm long; inner 3 stamens with extrorse cells, the filaments with 2 glands near the base, filaments and anthers each ca. 1 mm long; staminodia lacking; ovary glabrous, enclosed in the cupshaped, pubescent floral tube, globose, ca. 1 mm diam.; style ca. 2 mm long, the stigma platelike, ca. 0.7 mm diam. Infructescence woody, glabrous, the cupule a shallow, small cup, ca. 1.5 cm wide and 0.7 cm tall (outside) with few, rather large lenticels. Fruit a 1-seeded berry, broadly ellipsoid, to 3 cm long and 2.5 cm wide when dry; young cupule with weakly lobed margin, margin becoming straight at maturity.

Paratypes. COLOMBIA. DEPTO. CAUCA: *Cuadros 359* (MO), *Cuatrecasas 18942* (MO, F). DEPTO. NARIÑO: *Soejarto 1999* (F). DEPTO. DEL VALLE: *Cuatrecasas 17910* (F), *Cuatrecasas 20418* (F), *Cuatrecasas 20588* (F), *Cuatrecasas 21906* (F, US), *Cuatrecasas 21922* (F, U), *Devia 649*. ECUADOR. PROVINCE CARCHI: *Balslev et al. 2620* (AAU, NY), *Tipaz 10* (MO, QAME), *Tipaz 85* (MO, QAME), *Tipaz 87* (MO, QAME). PROVINCE NAPO: *Holm-Nielsen et al. 29858* (AAU), *Jaramillo 7686* (GB). PROVINCE AZUAY: *Camp E-4808* (MO, NY), *Harling & Andersson 21177* (GB), *Jaramillo 7149* (GB), *Knight 218* (WIS), *Steyermark 53424*, *53425* (F). PROVINCE LOJA: *van der Werff & Palacios 9426* (AAU, HBG, MO, QAME). PROVINCE UNKNOWN: *Espinosa 1087* (F, NY).

Flowers and fruits year-round.

Ocotea infrafoveolata is a high-elevation (between 2,600 and 3,400 m) shrub or small tree, only known from southern Colombia and adjacent northern Ecuador and south of Cuenca in Ecuador, with one collection in central Ecuador. Its affinities in *Ocotea*, a largely neotropical genus of probably more than 300 species, are not clear. The shape of the inflorescence, the cupule, leaf shape, and decurrent leaf bases suggest an affinity to *O. calophylla* Mez, *O. sericea* HBK, and *O. micans* Mez, all densely pubescent, high-elevation species of northern South America and Costa Rica. However, none of these species have a foveolate lower leaf surface and all have unisexual flowers. Some collections of *O. infrafoveolata* have slightly smaller flowers than others, but locelli of both smaller and larger flowers contain pollen, even on specimens with old fruits. Because the unisexual character of *O. calophylla* and *O. sericea* is quite obvious, it is unlikely that the smaller and large flowers of *O. infrafoveolata* represent different sexes. Another difference is the absence of vernation lines on the leaves of *O. infrafoveolata*, while these

are conspicuous on the leaves of *O. calophylla* and related species.

In spite of these differences, *O. infrafoveolata* seems to be related to the group of *O. calophylla*. There are other species of Lauraceae restricted to high elevations in the Andes and with a similar pubescence, but these species (in *Ocotea* and *Persea*) differ clearly in floral and cupule characters, and the ferruginous pubescence is more likely an adaptation to cold, wet habitats than an indication of taxonomic relationship.

Ocotea rotundata van der Werff, sp. nov. TYPE: Ecuador. Prov. Loja: Parque Nacional Podocarpus, along road from Yangana to radio tower on Cerro Toledo, cloud forest, 2,900 m, 29 Apr. 1987, *van der Werff & Palacios 9192* (holotype, MO; isotypes, AAU, HBG, QAME). Figures 6, 3G–J.

Ocoteae arnottianae similis, sed foliis rotundatis, petiolis brevioribus et pubescentia longiore differt.

Shrub or small tree, to 10 m tall. Twigs slightly angular and rufous tomentose when young, becoming terete and glabrous with age. Terminal bud ca. 9 mm long, rufous tomentose. Leaves alternate, 5–8 × 4.5–6 cm, broadly elliptic, the smallest leaves often roundish, coriaceous, the base rounded, the tip rounded or with a very short acumen, the upper surface glabrous (young leaves with some rufous pubescence along costa and veins, but this wearing off very quickly) and with costa and veins immersed, the lower surface rufous tomentose, color of the tomentum fading on old leaves and the tomentum wearing off, but leaves very rarely becoming glabrous, costa and veins elevated on lower surface, but tertiary venation not visible; margin plane, not thickened; veins 4–6 pairs, the lower 2 or 3 close together near the base of the leaf. Petioles 3–6 mm long, to 4 mm thick, with similar type and density of pubescence as the twigs. Inflorescences axillary, 6–12 cm long, rufous tomentose, paniculate or, when small, racemose, the flowers usually arranged in cymes. Flowers perfect, pale yellow or creamy, the floral tube deep and gradually narrowed in the very short pedicel. Pedicels, floral tubes, and the outside of the tepals ferruginous tomentose (inner tepals with glabrous margin and tip). Tepals 6, ovate, ca. 3 mm long, the inner surface with some papillose pubescence near the apex, this best visible in young flowers, otherwise glabrous. Stamens 9, all 4-celled (but many flowers with 1 or 2 cells apparently sterile; the position of the sterile cells variable), the cells arranged in 2 horizontal rows; filaments of the outer stamens ca.



FIGURE 6. *Ocotea rotundata*.

0.8 mm long, dorsally with a narrow row of hairs; anthers of the outer stamens curved inward, their cells introrse; inner stamens erect, ca. 1.6 mm long, the pubescent filament as long as the anther, glands large, attached near the base of the filament; upper pair of anther cells lateral, the lower pair extrorse; staminodia ca. 1 mm long, the lower part pubescent, the tip glabrous and swollen. Pistil ca. 2.5 mm long, glabrous; ovary enclosed in the deep floral tube, floral tube densely pubescent inside. Fruit ellipsoid, 2×1.5 cm, cupule funnelshaped, with a weakly developed double margin.

Paratypes ECUADOR. PROVINCE LOJA: Parque Nacional Podocarpus, *Molau & Eriksen* 3217 (GB), *Larsen & Dall* 229 (GB), *Stein & D'Alessandro* 2718 (MO), *van der Werff & Palacios* 9189, 9195, 9283, 9285, and 9321 (all MO, HBG, QAME).

Ocotea rotundata is known only from the Parque Nacional Podocarpus, to the south of Loja, at elevations of ca. 3,000 m. It only grows in wet

habitats; it has not been collected on the drier slopes to the north and west of Loja, such as Cerro Villonaco. The new species belongs to the *Ocotea aciphylla* (Nees) Mez group, as circumscribed by Rohwer (1986). Characteristics for this group are hermaphroditic flowers, a deep floral tube (and large cupule in fruit), rather large staminodia, and basal lateral veins that are close together. Although this group includes mostly lowland species, several Andean species (*O. arnottiana* (Nees) van der Werff, *O. heterochroma* Mez & Sodiro, *O. jelskii* Mez, and *O. stuebelii* Mez) belong here as well. These species, which are not well known, differ from *O. rotundata* in having narrower leaves with acute tips and bases and longer petioles, as well as in details of the pubescence. In leaf shape, *O. rotundata* is very similar to *O. julianii* van der Werff (*Phoebe steyermarkii* Allen; van der Werff, 1989). The latter is restricted to the summit areas of Chimantá-tepui, Edo. Bolívar, Venezuela, and differs in its shorter, often darker tomentum on the

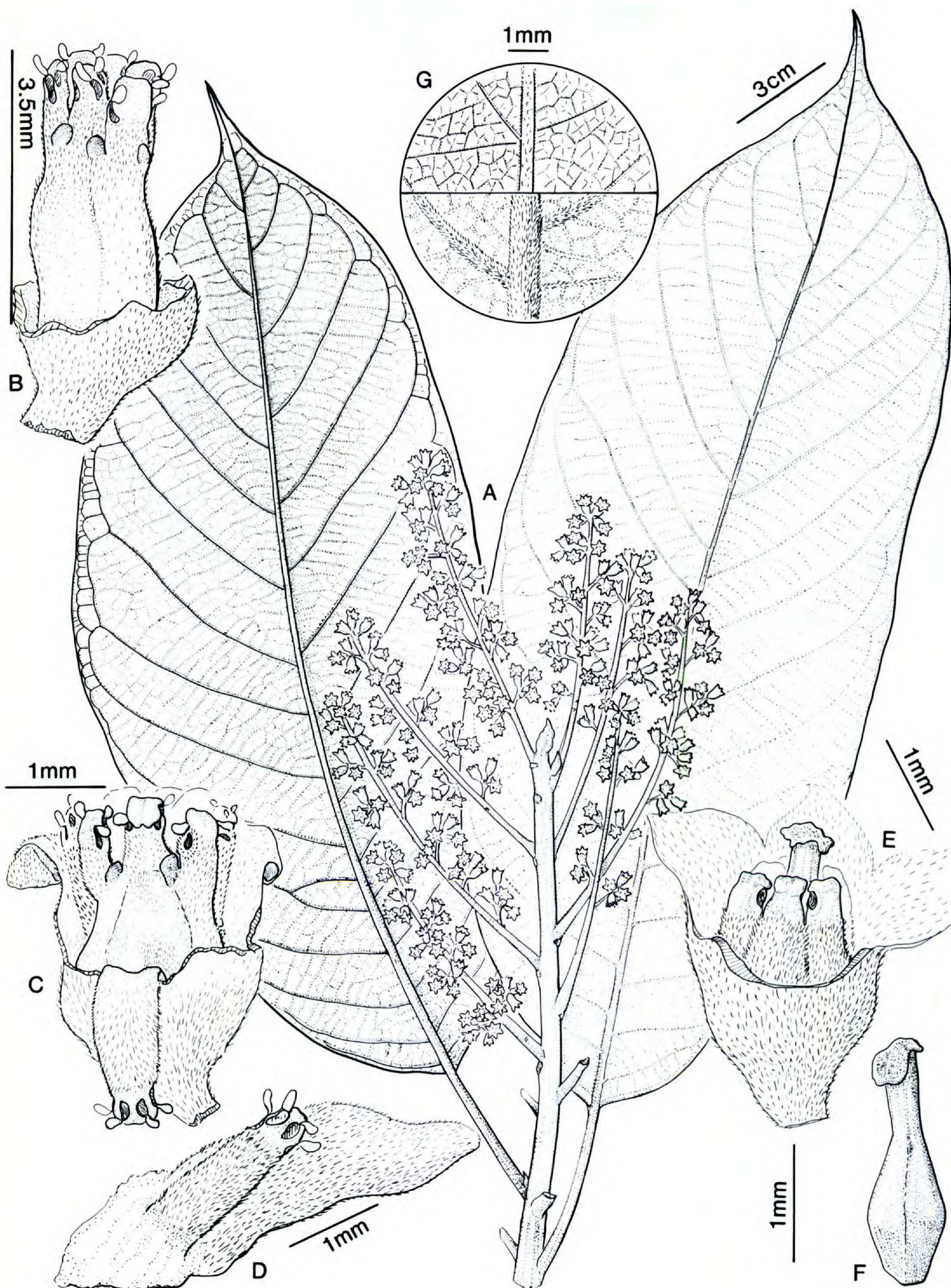


FIGURE 7. *Rhodostemonodaphne synandra*. — A. Habit. — B. Staminate flower, tepals and stamens of whorl I removed. — C. Staminate flower, showing free stamen of whorl I and partially fused stamens of whorls II and III. — D. Tepal with stamen of whorl I. — E. Pistillate flower, some tepals and stamens of whorl I removed. — F. Pistil. — G. Detail of pubescence and venation on lower leaf surface (lower half) and upper leaf surface (upper half).

leaves, shorter tomentum on the twigs, a much larger cupule and fruit, and its distribution.

Rhodostemonodaphne synandra van der Werff, sp. nov. TYPE: Ecuador. Napo: Estación Biológica Jatun Sacha, 8 km downstream from Puerto Misahualli, tree, 30 m, ♂ flowers green, Neill & Palacios 7129 (holotype, MO; isotypes, QAME, HBG). Figure 7.

Ab *R. kunthiana* foliis oblongis, pubescentia cinnamomea, floribus glomeratis, filamentis staminum serierum II and III $\frac{2}{3}$ connatis, et glandulis minoribus late differt.

Dioecious tree, to 30 m. Twigs hollow, slightly angled to round, densely yellow-brown tomentellous when young, the indumentum diminishing with age. Terminal bud densely tomentellous. Leaves alternate, elliptic or oblong, 20–30 × 7–11 cm, stiffly chartaceous, the base acute or obtuse, the apex acuminate; upper surface glabrous (except some pubescence on the midrib), often shiny, midrib and lateral veins immersed, but tertiary venation raised; lower surface with raised midrib, lateral veins and tertiary venation, the entire venation system laxly tomentellous; lateral veins 10–15 pairs. Petioles 2–3 cm long, brown-tomentellous, canaliculate. Staminate inflorescences axillary, to 10 cm long, yellow-brown tomentellous; the lower flowers of the inflorescence clustered near the tips of lateral axes, these axes becoming shorter toward the tips of the inflorescence; pistillate inflorescences to 7 cm long, unbranched, the flowers clustered along the main axis. Flowers gray-tomentellous, sessile or nearly so, campanulate, 3 (dry) to 5 (after boiling) mm long. Staminate flowers: tepals 6, equal, spreading to reflexed at anthesis, tomentellous outside, sparsely pubescent and slightly papillate inside, ca. 2 × 1.2 mm. Stamens 9, all 4-celled; outer 3 stamens attached near the base of the floral tube, ca. 3 mm long, the pubescent filament wider than the glabrous anther, the upper cells introrse, the lower lateral; stamens of whorl II and whorl III ca. 3 mm long, their filaments fused for the lower 2 mm and free for the upper 1 mm, forming a central column; anthers of whorl II with introrse cells, of whorl III with extrorse cells; stamens of whorl III with 2 glands attached at the base of the free part of the filament; staminodia (whorl IV) and pistillode not seen. Floral tube pubescent inside. Pistillate flowers: staminodia of whorl I ca. 1.5 mm long, free, the thick, fleshy filament pubescent, the tip glabrous, cells rudimentary, introrse; filaments of whorls II and III partly connate, only upper part free; glands of whorl III attached at the base of the free part of the stamens, glabrous, small; ovary

ellipsoid, ca. 2 mm long, glabrous; style distinct, ca. 1.5 mm long; floral tube glabrous inside. Fruits unknown.

Paratype PERU. HUANUCO: Fundo Sinchona, km 209 carretera Huanuco–Pucallpo, 1,200 m, Hodge & Lescano 1, ♀ (fl) (F); same locality, Lescano 2 ♀ (fl) (MAD).

Rhodostemonodaphne synandra is only known from the three cited collections. The two Peruvian collections carry exactly the same label information, were both collected on 9 October, and are both pistillate; it is probable that they are the same collection and that the label erroneously states that one specimen (MAD) was collected in 1945 and the other (F) specimen in 1944.

Vegetatively, *Rhodostemonodaphne synandra* is quite similar to the widespread *R. kunthiana* (Mez) Rohwer. *Rhodostemonodaphne synandra* differs in its yellow-brown pubescence (ferruginous brown in *R. kunthiana*) and its narrower, more oblong leaves. The inflorescence of *R. synandra* is smaller, with clustered, nearly sessile flowers. The flowers themselves are highly diagnostic. They are larger than in *R. kunthiana*, and the stamens are attached near the bottom of the floral tube, not near the margin, as in *R. kunthiana*. The filaments are, for the genus, very long, but even more remarkable is that the filaments of the stamens of whorls II and III are fused for $\frac{2}{3}$ of their length. Usually, when there are differences between the staminal whorls in Lauraceae flowers, whorls I and II are similar and differ from whorl III, for instance in *Kubitzkia*, where the filaments of whorl III are fused, but those whorls I and II are free. Thus, the situation in *R. synandra*, where whorl I is separate from the fused whorls II and III, is highly unusual. An additional difference between *R. synandra* and *R. kunthiana* is that *R. kunthiana* has large, staminal glands which are visible between the outer stamens at anthesis, whereas in *R. synandra* the glands are small and only visible in dissected flowers. Meissner (1864) coined the name *Synandrodaphne* because the very bases of the stamens were fused into a ring like structure. I use the epithet *synandra* for a different reason, namely the fusion of the filaments of the stamens of whorls II and III.

Rhodostemonodaphne is a small neotropical genus of about ten species, recently named by Rohwer & Kubitzki (1985), who raised *Nectandra* subg. *Synandrodaphne* to generic level. Because *Synandrodaphne* Gilg is conserved over *Synandrodaphne* Meissner, they proposed the name *Rhodostemonodaphne*. With two exceptions (*R. grandis* (Mez) Rohwer and *R. kunthiana* (Nees)

Rohwer), the species placed in *Rhodostemonodaphne* by Rohwer (1986) are very poorly known. *Rhodostemonodaphne* is characterized by the following combination of characters: flowers unisexual; anthers 4-celled, the cells arranged in an arc; filaments poorly (or not at all) differentiated from the anther; staminodia lacking; and pubescence usually dense. The exclusion of *Rhodostemonodaphne* from *Nectandra* strengthens the unity of *Nectandra* and seems fully justified.

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